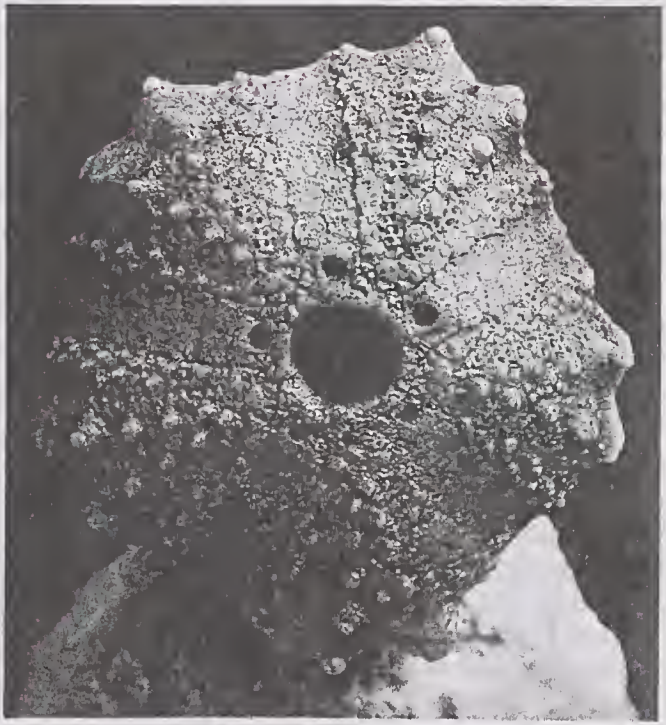
THE FOSSIL COLLECTOR

BULLETIN No. 68 JANUARY 2003



The Arbaciid *Murravechinus paucituberculatus* (Gregory, 1890) x 5.75, from the Morgan Limestone at Overland Corner, South Australia.

Published by
THE FOSSIL COLLECTORS' ASSOCIATION OF AUSTRALASIA
ISSN 1037-2997

THE FOSSIL COLLECTORS' ASSOCIATION OF AUSTRALASIA

SECRETARY/TREASURER
Frank Holmes. 15 Kenbry Road, Heathmont, Victoria. 3135. (03) 9729 0447
E-mail: fcholmes@tpg.com.au

EDITOR
Paul Tierney. 2 Mahogany Dve, Caboolture, Qld. 4510. (07) 5499 0875
E-mail: palaeo@microed.com.au

STATE REPRESENTATIVES

Australian Capital Territory
Mrs. M. Webb. Fairlight Station, R.M.B. 141, Weston. 2611. (02) 6236 5123

New South Wales
Eric Nowak. 29 Bungalow Road, Roselands. 2196. (02) 9758 1728

South Australia
John Barrie. 1 George Terrace, Coonalpyn. 5265. (08) 8571 1172

Queensland
Ian Sobbe. M/S 422, Clifton. 4361. (07) 4697 3372

Victoria
Frank Holmes. 15 Kenbry Road, Heathmont. 3135. (03) 9729 0447

Western Australia
Mrs. L. Schekkerman. 11 Marion Street, Innaloo. 6018. (08) 9446 3583

Taxonomic Disclaimer

This publication is not deemed to be valid for taxonomic purposes [see article 8b in the *International Code of Zoological Nomenclature* 3rd edition 1985. Eds W. D. Ride et al].

CONTENTS

EDITORIAL NOTES

Welcome to 2003 and another year of CCIC (**C**ollecting, **C**leaning, **I**dentifying and **C**ataloguing), I still have quite a bit of the material collected during 2002 to identify and catalogue, but, if everything was up to date then something would not be quite right.

A friend has been doing quite a bit of research on further Triassic deposits in the southeast corner of Queensland and it would appear we now have several more areas to investigate over the coming cooler months. We are hoping to find some more insect deposits (or are we) along with some more freshwater bivalves and if we are really lucky, perhaps that elusive fish or small predator.

Now for the unsavory but necessary part of the issues Editorial Notes.

The management of Wrotham Park Station (home of the Walsh River ammonite) has advised that due to wonton damage to station property and fossil deposits by over zealous visitors and commercial collectors, the property has been officially closed to the public. Fences and signs have been erected and trespassers will be liable to prosecution. Museums, universities and similar institutions will still be allowed access but only after permission for entry is granted. All visitors granted permission to enter the property are first required to check in at the homestead and fill in a form detailing their whereabouts and estimated duration of visit, similarly the time of departure must also be recorded at the homestead. Shareholders of the company that owns Wrotham Park **DO NOT** have unrestricted access to the property. Trespassing is an offence and will be policed.

It has also been passed on that May Downs Station (home of the Beetle Creek trilobite) has also been shut down to collectors, for pretty much the same reason. There are also reports of several other areas and properties in Queensland that are being shut down or having collecting severely restricted.

It is truly a shame that access to fossil collecting areas is becoming harder and more difficult to attain. This is obviously due to many reasons with probably (for me) the most obvious being the fear of property owners and managers being sued for injuries to people who have illegally entered property. One can only hope that, perhaps, with a

great deal of hard work, the presently developing situation will reverse and access might again be granted.

Now for an update on the field trip to northern Queensland some good mates and I went on during August last year. It appears that we have made a couple of new discoveries which has served to put the icing on an already great trip. At a Cretaceous site we visited we found several limpet specimens and these are the oldest occurrence of this mollusc in Australia. The specimens we recovered from an already known Plio/Pleistocene vertebrate locality has greatly increased the interest in this area with the possibility of some new discoveries to be made. We also collected the most complete (to date) crinoid calyx from the Permian of Queensland, we actually collected two along with some holdfasts for good measure. Although we may have travelled several thousand kilometres for only a few new discoveries, it is these few that help make it all worthwhile. The company of friends, meeting new people and seeing some beautiful scenery are also some of the highlights of traveling off the bitumen, the scenery alone is worth all the time behind the steering wheel.

This year will see me being involved with CAVEPS so a major field trip will not be possible, however, there will be the opportunity to go on a few weekend trips which should see me collecting from some new and some rediscovered Triassic localities in the southeast corner of Queensland. We are, as many would guess, continuing our search for Triassic insects, but we are also hoping to find more specimens of the freshwater bivalves (paper currently in press) that we have been finding at other localities.

Readers will notice that this issue is a different size to that of previous issues. We have moved to a folded A4 size as this size paper is more readily available and, I believe, somewhat cheaper than foolscap. The new paper size has not meant a drop in the total content of *The Fossil Collector*, believe me when I say there is exactly the same amount of text in this size as there was the foolscap size. The only thing that might be noticed is that the text size is a very small fraction smaller than it was.

Thank you to Ken Bell, Robert Knezour and Frank Holmes for their contributions to this issue of *The Fossil Collector*, I appreciate it. The deadline for Bulletin 69 will be March 26, 2003.

TERTIARY STYLASTERIDS

By K.N. Bell

In the residues of washings of Tertiary sediments, there may be a rich fauna of foraminiferans, ostracoda, micromolluscs, small corals, bryozoans, fish otoliths and grinding plates and other more unusual fossils. This is certainly true of the washings of the Miocene Fyansford Formation marls at Batesford Quarry, Victoria, where many unusual and rarely recorded fossils are present. Amongst these rarities are numerous fragments of Styasterid species.

Styasterids belong in the Hydrocorallina within the Cnidaria, they are colonial animals with each animal connected to the others. They secrete a calcareous skeleton (the **corallum** or **coenosteum**), this skeleton has a superficial similarity to bryozoans but the two groups are totally unrelated, with significant skeletal differences. Stylasterids have a mainly subtropical to tropical distribution in modern seas and very little is known of the recent Australian fauna.

The zooids in a colony show specialization of function: there are the food processors or **Gastrozooids**, the defensive zooids or **Dactylozooids**, and the reproductive zooids or **Gonozooids**. The zooids are placed in pores on the skeleton called the **Gastropores**, **Dactylopores** and **Ampullae** respectively, with the relative arrangement of the gastropores and dactylopores being used as a basis for classification. In some genera, the gastropore is surrounded by a circle or arc of dactylopores, an arrangement called a cyclosystem. These cyclosystems may be regularly or irregularly placed over the skeletal surface, and may even have different shapes in juvenile and adults parts of the skeleton. In other genera, the gastropores and dactylopores are scattered seemingly at random over the skeletal surface. Recent Stylasterids have an upright, aborescent growth, many with an almost planar structure.

The records of fossil Stylasterids are meagre, for Australia I can find only three papers. T.S. Hall (1893 a, b) first recorded their occurrence as fossils in Victoria (as two new genera and species, *Deontopora mooraboolensis* and *Leptobothrus spenceri*) in clays from Orphanage Hill and Belmont, near Geelong and at Snapper Point in Port Phillip Bay - these are Lower to Middle Miocene in age; he had very few specimens. In 1898 he reported a further two genera, of which one

species was identified with a living form (*Sporadopora dichotoma*) and the other left as a generic determination only (*Distichopora* sp.) - unfortunately neither of these additional records was figured.

Careful picking through the residues from Batesford Quarry as well as at Red Bluff, Shelford and Muddy Creek, Hamilton, has produced specimens of all of these species as well as some examples of what appear to be further species as yet undescribed.

I believe that further specimens of these (and perhaps other species) should be found in any of our Tertiary marly limestones, I would be pleased to hear from anyone who finds any other specimens. Hall stated 109 years ago "…. there are sure to be many more [species] not yet descibed…." and, with no study having been done on these fossils since his time, it is still, surely, as true today.

Notes on the species:
Leptobothrus spenceri Hall, 1893. (Figures 1a & b).
All the fragments of this species are cylindrical and it is not possible to say what the gross shape of the corallum would have been. The corallum has circular cyclosystems (Fig. 1a) which project at about right angles to the 'stem'. Each cyclosystem consists of a large central gastropore surrounded by 8 to 10 dactylopores. In well preserved specimens the skeleton around the dactylopores is extended as short 'fingers'. There are other smaller, elongated pores scattered over the surface of the corallum (Fig. 1b) with, most usually, a larger one just below each cyclosystem - these larger pores are the exit of the ampulae which are not exposed externally. In very worn specimens the projecting cyclosystem may be worn right down to the main body, but by careful inspection the dactylopores can still be determmined in the ring about the larger gastropore.

In his paper, Hall (1898) suggested that this taxon was synonymous with the bryozoan *Porina gracilis* (Lamarck) but comparison with specimens of *P. gracilis* (which occur in the washings also) shows this not to be so (an excellent photograph of *P. gracilis* is in Bock, 1982). *L. spenceri* has well defined cyclosystems which are quite pronouncedly projecting from the main body, whilst *P. gracilis* has a regular arrangement of zooids, flush with the surface, each of which has a secondary circular or elongated orifice and each zooid has a frontal wall of a porous network. Also *P. gracilis* colonies are normally

flattened whereas in *L. spenceri* the corallum is cylindrical. This error of Hall's could have come about because very worn specimens, without the projecting cyclosystems, can be hard to differentiate from *P. gracilis*.

Fig. 1a

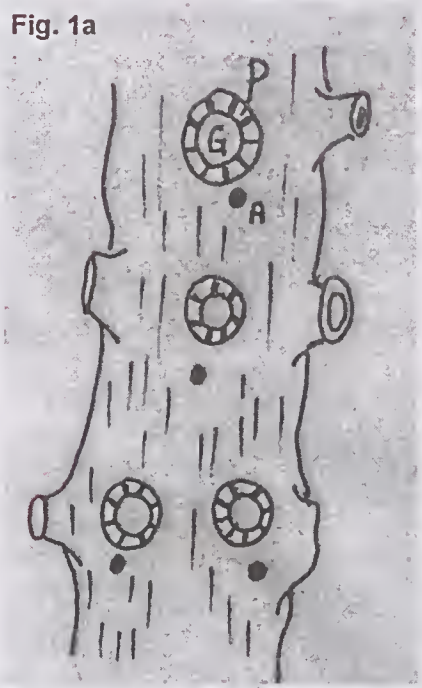
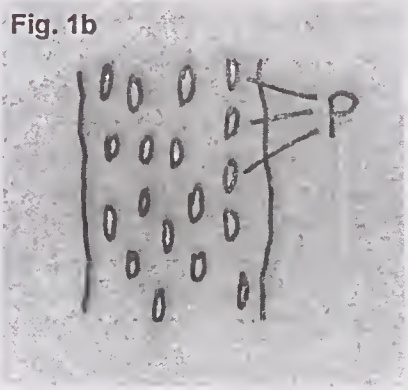


Fig. 1b



Figures 1 a-b. *Leptobothrus spenceri* Hall. a, typical corallum; b, close up of wall showing the scattered, small pores over the surface. G, gastropore; D, dactylopore; A, opening to ampula; P, elongate wall pores. Figure not to scale.

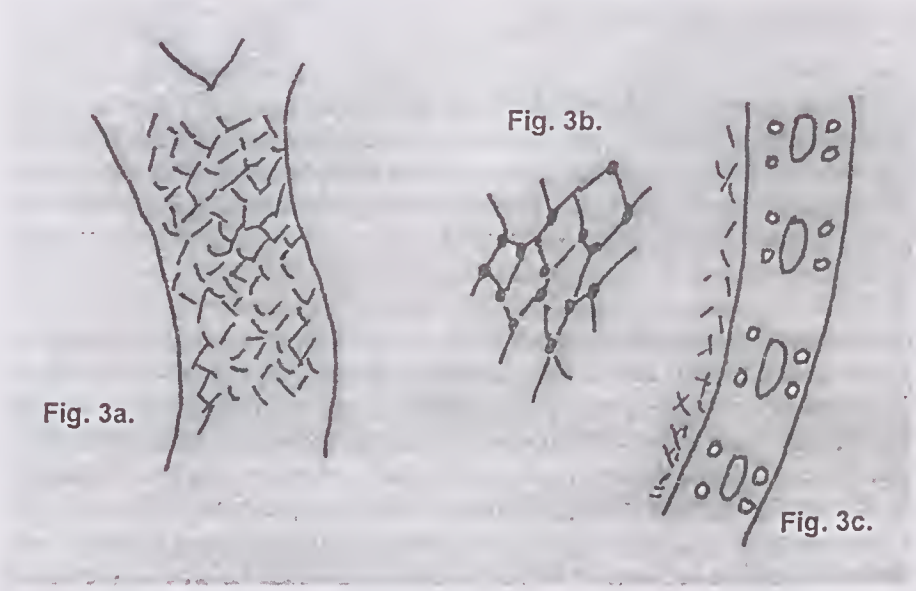
Sporodopora dichotoma Moseley, 1878 (Figure 2) is a living stylasterid and, as stated by Hall (1898), the skeleton of the fossil specimens does not seem to differ in any respects from the living form (recent specimens of the species from Fiji were available for comparison). This species does not have a cyclosystem of pores, but over the surface, circular pores of various sizes are scattered irregularly. Hall recorded this *S. dichotomosa* only from Grange Burn, Hamilton but I have specimens from both Batesford Quarry and Red Bluff.

Fig. 2

Figure 2. *Sporodopora dichotoma* Moseley. A typical corallum with scattered small pores over the surface. Figure not to scale.

?Distichopora sp. (Figures 3a - c).

This genus is characterised by the round gastropores lying linearly along the edges of the branches, with the dactylopores arranged in two rows bordering the gastropores. The surface of the corallum is finely reticulate, with minute pores at the junctions of most of the ridges. I am uncertain of the true taxonomic placement of the few specimens from Batesford Quarry because, although they agree quite well with Hall's description (Hall 1898), in none of the specimens is there a style present in the gastropore, a characteristic of this genus (Moseley 1878). Hall (1898) did not mention this feature as being present in his specimens from Hamilton. So until better preserved material becomes available, the generic placement is questionable. Only very rare specimens have been recovered from Batesford Quarry, while Hall also recorded it from Muddy Creek and Grange Burn.



Figures 3 a-c. *?Distichopora* sp. a, typical corallum fragment, with a fine tracery of ribs; b, close up of wall showing the fine ribs with very small pores at the intersections of ribs; c, edge view of corallum showing the placement of gastropores (large ovals) and dactylopores (small circles). Figure not to scale.

Deontopora mooraboolensis Hall, 1893. (Figures 4a - e).
This is the most common of the several taxa to be found at Batesford Quarry. It shows a wide variation in growth form which indicates it had a branching but planar habit. In older parts of the colony (Fig. 4a) the cyclosystems are more or less semicircular and arranged alternately on opposite sides of the 'stem', but in the younger parts (Fig. 4b) - perhaps near the top of the colony - the cyclosystems are circular with newer growth coming from one side of the cyclosystem. The dactylopores occur around the rim of the gastropore with each dactylopore being in a deep, broad groove, radial to the gastropore (Figs. 4c & d). There is no style present in either the gastropore or dactylopore. The surface of the corallum is covered with low cord like ridges, more or less parallel, with narrow slit like pores between the ridges (Fig. 4f). The ampulae are inflated, dome shaped and placed at random over the skeleton (Fig. 4e, A1); sometimes they may be very common and crowded together, or they may just occur as single bodies.

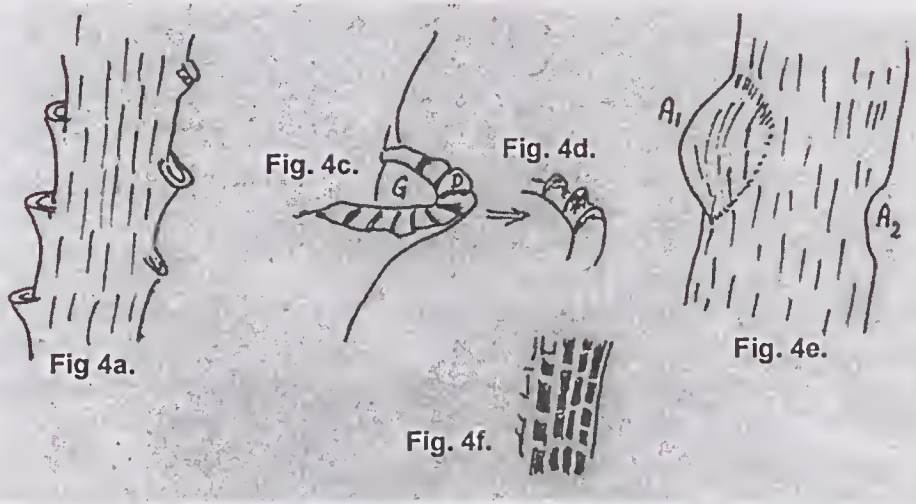



Fig. 4b.

Figures 4 a-f. *Deontopora mooraboolensis* Hall. a, typical fragment of adult corallum; b, juvenile fragment showing different growth style; c, closer view of a single cyclosystem showing the gastropore and dactylopores in the encircling groove; d, in well preserved specimens the edges of the dactylopores stand above the rim; e, domelike entire ampula (A1) and section through an ampula without a top (A2); f, close up of wall showing the elongated pits between the ridges. Figure not to scale.

Often there is only a depression present on the stem (Fig. 4e, A2); Hall thought this suggested that the top of the ampula was thin and so could easily be broken, however, none of my specimens show signs of rough edges around the depression which would indicate a break. The surface ridges continue over the swellings of the ampulae and are also present on the floor of the depressions.

Contrary to Hall (1898) who suggested that the reproductive planulae were released through a basal pore which he stated could be found in most ampulae, extremely few of the present several dozen specimens show any basal ampula pore and so perhaps the planulae can just diffuse through the normal pores between the ridges on the ampula surface. This taxon is also present at Red Bluff, Shelford and Muddy Creek.

References

Bock, P. E. 1982. Bryozoans (Phylum Bryozoa or Ectoprocta). In *Marine Invertebrates of Southern Australia, Part 1.* (eds S. A. Shepard & I. M. Thomas), pp 319-394.

Hall, T. S. 1893a. On two new Tertiary Stylasterids. *Proceedings of the Royal Society of Victoria* 5: 117-122.

Hall, T. S. 1893b. Notes on two recently described fossils from Geelong. *The Geelong Naturalist* 2: 3-5.

Hall, T. S. 1898. Stylasteridae from the Victorian Tertiaries. *Proceedings of the Royal Society of Victoria* 10: 175-179.

BOOKS AND BOOK REVIEWS

AMMONITES by Neale Monks and Philip Palmer. Published by *The Natural History Museum*, London, 2002 (159pp). ISBN 0-565-09169-7. Price in Australia AU$49.95 [copy obtained from Melbourne Museum Bookshop].

As the authors note in the Preface, most of what is written about ammonites is found in scientific journals. However, this book is an account of the natural history of the ammonites written specifically for the general reader. Since the last such book, written by Ulrich Lehman and published in English in 1981, there have been some fundamental changes in the way ammonites are envisaged, in particular the switch away from the nautilus as the prototype of the ammonite animal

towards the more active cephalopods like the octopus. The most important of these new observations and ideas are described in this book.

The book does not include stratigraphical and geological occurrences or detailed descriptions of ammonite taxonomy, rather placing the accent on the biology of the ammonites to enable students and enthusiastic amateurs to understand the sometimes tricky field of ammonite palaeoecology.

This information is provided in six chapters, which cover a general introduction, ammonite fossils, ammonite form & function, aspects of biology, taxonomy & classification, and finally, extinction. This is followed by details of other books, scientific literature, general topics and the addresses of three websites, as well as a six-page glossary of terms and full index.

The book is easily readable and well illustrated with diagrams and photographs, fourteen pages of the latter in colour, one of which (plate 21) showing a magnificent slab of 'ammonite marble' cut and polished for ornamental use.

Because this soft cover book is published in the U.K., the Australian price of $49.95 might be considered a little high. However, if you are an ammonite enthusiast, it is well worth the cost.

Reviewed by Frank Holmes

RIVERSLEIGH SYMPOSIUM 1998. Proceedings of a research symposium on Tertiary fossils from Riversleigh and Murgon, Queensland, held at the University of New South Wales, December 1998, edited by S. J. Hand & J. R. Laurie. *Memoir 25 of the Association of Australasian Palaeontologists*, 154p. (softcover). Price (including postage and GST) AU$65.00 within Australia, AU$70.00 overseas (Sea Mail). Available from the Geological Society of Australia, Suite 706, 301 George Street, Sydney, NSW 2000. Telephone: (02)92902194, Fax: (02)92902198.

This Memoir, published in 2001, consists of eleven papers based on presentations given at the Riversleigh Symposium in 1998. These are:

Montypythonoides: the Miocene snake *Morelia riversleighensis* (Smith & Plane,1985) and the geographical origin of pythons – *John Scanlon.*

A new Eocene soft-shelled turtle (Trionychidae) from Murgon, south- eastern Queensland – *Arthur W. White.*

A swiftlet (Apodidae: Collocaliini) from the Oligo-Miocene of Riversleigh, northwestern Queensland – *Walter E. Boles.*

A new genus and species of dasyuromorphian from the Miocene of Riversleigh, northern Australia – *Stephen Wroe.*

New Oligo-Miocene pseudocheirids (Marsupialia) of the genus *Paljara* from Riversleigh, northwestern Queensland – *Mina Bassarova, Michael Archer & Suzanne J. Hand.*

Wyulda asherjoeli, a new phalangerid (Diprontodontia: Marsupialia) from the early Miocene of Riversleigh, northwestern Queensland – *Kirsten Crosby, Marika Nagy & Michael Archer.*

A review of macropodoid (Marsupialia) systematics with the inclusion of a new family – *B. P. Kear & B. N. Cooke.*

Bulungamayine (Marsupialia: Macropodidae) postcranial elements from the late Miocene of Riversleigh, northwestern Queensland – *B. P. Kear, M. Archer & T. F. Flannery.*

Postcranial morphology of *Ganguroo bilamina* Cooke, 1997 (Marsupialia: Macropodidae) from the middle Miocene of Riversleigh, northwestern Queensland - *B. P. Kear, M. Archer & T. F. Flannery.*

New Miocene *Icarops* material (Microchiroptera: Mystacinidae) from Australia, with a revised diagnosis of the genus – *Suzanne Hand, Michael Archer & Hank Godhelp.*

The Encore Local Fauna, a late Miocene assemblage from Riversleigh, northwestern Queensland – *Troy Myers, Kirsten Crosby, Michael Archer & Michael Tyler.*

EARLY CRETACEOUS (NEOCOMIAN) FLORA AND FAUNA OF THE LOWER STRZELECKI GROUP, GIPPSLAND, VICTORIA by S. McLoughlin, A.-M. P. Tosolini, N. S. Nagalingum & A. N. Drinnan. *Memoir 26 of the Association of Australasian Palaeontologists*, 144p. (softcover). Price (including postage and GST) AU$70.00 within Australia, AU$72.00 overseas (Sea Mail). Available from the Geological Society of Australia, Suite 706, 301 George Street, Sydney, NSW 2000. Telephone: (02)92902194, Fax: (02)92902198

Fossil assemblages are described from the Tyers River Subgroup (late Berriasian to Hauterivian), Gippsland Basin, Victoria. These include plant macrofossils referable to 33 form-species, of which five are new,

and three new combinations. Macrofossil assemblages include representatives of the Hepaticales, Isoetales, Equisetales, Filicopsida, seed-ferns, Coniferales and unionid bivalves. Co-preserved mesofossil suites described include dispersed cuticle fragments, seed coats, seed megaspore membranes, microspore clusters, fern leptosporangia, charcoalified wood, resin blebs, epiphyllous fungal shields, clitellate annelid cocoons, insect exoskeleton fragments and coprolites. Sixteen lycophytic megaspore taxa are identified from the succession and represent the first Neocomian megaspores formally described from Australia. The Tyers River Subgroup shares some taxa with the well studied Aptian Koonwarra flora of the Gippsland Basin but lacks several key elements (Ginkgoales, angiosperms and large-leafed araucarian conifers) and is more closely comparable to the Jurassic floras of eastern Australia in its strong representation of bennettitalean, pentoxylalean and other seed-fern remains

[Other publications available from the GSA can be viewed on www.gsa.org.au]

THE DINOSAUR DEALERS. Mission to uncover international fossil smugging by John Long. Published by Allen & Unwin, Australia, 2002 (220pp). ISBN 1865088293 (paperback). Recommended Retail Price, AU$29.95.

This book is a tie-in with the TV documentary screened on SBS in November 2002, and deals with an attempt by palaeontologist John Long (Western Australian Museum, Perth) in conjunction with Sgt Steve Rodgers, a policeman from the United States who specialises in fossil theft, to recover rare dinosaur prints stolen in October 1996 from an isolated beach near Broome in Western Australia.

Together they explore the secretive world of the multi-million dollar international fossil trade, interviewing shonky dealers with criminal backgrounds and exposing the illegal world of fossil poaching and smuggling. These days, the sale of a dinosaur fossil for millions of dollars seems to take precedence over what scientific information may have been lost by inappropriate excavation, or even whether the specimen will end up in an a recognised museum and be preserved for all time.

PREHISTORIC MAMMALS OF AUSTRALIA & NEW GUINEA. One Hundred Million Years of Evolution by Michael Archer, Tim Flannery, Suzanne Hand & John Long. Published by UNSW Press, Sydney, 2002 (244pp). ISBN 0868404357 (hardback). Recommended Retail Price AU$69.95.

This book is a comprehensive reference to the extinct mammals of ancient Australia and New Guinea, including carnivorous kangaroos, the first koalas, huge Diprotodons, bizarre 'thingadontans', marsupial lions, ancient bats and rats, and marine mammals. Each animal is described and information is provided on each species' discovery and its relationship to other members of its group or family, including living species.

Beautiful full-colour plates bring together the knowledge and expertise of four of Australia's most distinguished palaeontologists, and showcases 60 superb colour paintings by biological illustrator Anne Musser.

LETTERS TO THE EDITOR

Please find below a letter from Queensland reader Robert Knezour which will, I hope, be the first in a revisited section of *The Fossil Collector.* As Robert suggests, perhaps a **Letters to the Editor** section could be a way of promoting discussion among us on different areas of the palaeontological world and maybe even taking me, as the Editor, to task for the things I write. I would also encourage people who wish to answer letters, then please do so.

Dear Sir,

Regarding the lack of articles submitted by FCAA members for inclusion in *The Fossil Collector.* I think part of the problem is that many members may wish to contribute, but lack the confidence to put together a formal article on a given topic. Perhaps encouragement could be given to someone with literary skills, writing a piece on how to go about constructing an article (where to start, where to finish and what to put in the middle).

A better idea might be the inclusion of a **Letters to the Editor** page in *The Fossil Collector.* This would, I am sure, be a great forum for

ideas and discussion on a wide range of subjects, and would stimulate more people to write. In other words, it would be easier to write a short letter on a subject you may feel passionately about, rather than spending a lot more time and effort on a long piece. I have a number of topics I would like to air in public, to see the kind of reaction they provoke, and I am sure others are the same.

Anyway, see what you think. If you agree then feel free to publish this as your first Letter to the Editor.

Yours Sincerely
R. Knezour

Robert,

Thank you for your letter and as you guessed it, we think a Letters to the Editor page is a good idea. You mentioned that you have a number of topics you would like to air in public, I would suggest that over the next few weeks you might want to start typing so I can publish them in the next issue.

Your idea of someone writing an article on how to go about producing an article is a good one and if any readers would like to take this on then please do so. I would also point out that in the past, Frank Holmes has offered his knowledge and experience in helping people produce an article for *The Fossil Collector*, I am sure this is something Frank would still like to offer. I have also suggested in the past that if people had an issue or question they would like to raise then they should do it, in light of your letter Robert, this is something I will suggest again. Perhaps this is why I sometimes write confrontationary Editorial Notes, to try and provoke a response.

Regards
Paul

The above is how I feel the **Letters to the Editor** section might be setout, however, if anyone thinks it should be done differently then please get in contact with me so we can discuss any possible changes.

IN THE NEWS

New Find: Pterosaur Had Strange Crest, Fishing Style

The 1.42 meter (4.7 feet) skull of a giant flying reptile that lived among dinosaurs suggests that it might have hunted for food like modern birds known as skimmers, using its scissors-like bill to snatch prey as it glided over water.

Thalassodromeus sethi, a previously undescribed pterosaur which lived in the Araripe Basin of northeastern Brazil 110 million years ago, had a wingspan of as much as 4.5 meters (15 feet), according to scientists Alexander W. A. Kellner and Diogenes de Almedia Campos at Museu Nacional/Universidade Federal do Rio de Janeiro and at Museu de Ciências da Terra in Rio de Janeiro. The pterosaur also had a large but thin bony crest. With the exception of one other species, *T. sethi* "has the proportionally largest crest known in any vertebrate, fossil or recent," the researchers report in the July 19, 2002, issue of *Science*.

Although scientists have been studying pterosaurs for over 200 years, a comprehensive understanding of their diversity and biology has been elusive due to the fragile nature of pterosaur fossils. Brazil's Araripe Basin is one of the few deposits where pterosaurs are found in large numbers with good preservation.

The fossil described in *Science* is rare in that the skull is almost completely intact. This allowed the researchers to perform a thorough analysis, gaining a better insight into *T. sethi*'s feeding behavior, and into the function of cranial crests in pterosaurs. The researchers speculate that *T. sethi*'s crest may have served several purposes. Grooves in the crest's bone show that it was densely packed with blood vessels, evidence that its primary function was probably to regulate its blood temperature, the scientists said. *T. sethi* might have been able to cool itself by circulating blood through the crest, dissipating excess body heat through convection. It may also be that the crests' distinctive shapes and color patterns enabled the pterosaur to recognize kin or differentiate between the sexes. Finally, the large size of the crest may indicate that it played a part in aerodynamics.

Carefully modulated flight would have been critical to *T. sethi*'s

survival. By comparing it to modern birds of the genus *Rynchops* (commonly called skimmers), Kellner and Campos concluded that *T. sethi* also fed by skimming across bodies of water and dipping its blade-like lower jaw into the water to scoop up its prey. Its distinctive elongated skull and specialized jaws are almost certain evidence that *T. sethi* caught its prey using this method, the researchers said. Unlike skimmers and other modern birds, however, *T. sethi*'s massive crest and less flexible neck would have prevented it from submerging its entire head when skimming, limiting its food supply to the animals at the very surface of the water.

But because of its large wingspan, *T. sethi* would have been able to glide over longer distances and flap its wings less frequently than modern birds, the scientists suggested. This would have allowed it to stay close to the surface of the water for longer periods of time.

Summary of story from *National Geographic News*, July 18, 2002.

Long Tail on Fossil of Ancient Bird Suggests Links to Dinosaurs

The fossil remains of an ancient bird with a stomach full of seeds and a tail like a dinosaur's have been unearthed from a province in China famed as one of the richest treasure troves of the dinosaur era. Larger than a modern crow, the creature provides the first hint of what birds ate nearly 125 million years ago, and the length of its tail strengthens the evidence that all birds are direct descendants of the dinosaurs, scientists say.

Zhonghe Zhou and Fucheng Zhang, paleontologists at the Chinese Academy of Sciences in Beijing, found the fossil remains in Liaoning province of Northeastern China. It's a region long noted for its wide varieties of dinosaur and bird fossils representing life during the Mesozoic era, the geologic time that began some 245 million years ago and ended 65 million years ago.

In the same western region of Liaoning province, scientists have recently found the fossils of feathered birds called *Confuciusornis* that lived about 140 million years ago and had already developed bird-like short tails. They also found evidence of another animal, called *Sinornithosaurus* dating from about 124 million years ago, that was more strictly a meat-eating dinosaur but whose skin was covered with fibers much like feathers, although it certainly had no wings.

Now comes the full-fledged bird whose fossil Zhou and Zhang have discovered and describe in the July 25, 2002, issue of the journal *Nature.* They have named it *Jeholornis prima*, its generic name after Jehol, the name of the region under the Mongols nearly 1,000 years ago, and its specific name after the primitive nature of the bird's tail. They place its age at between 110 and 124 million years old.

The bird had large, strong wings, a short, curved beak with few or no teeth, hook-like claws on its wings well adapted to flying as well as roosting in trees, and a bony tail nearly twice as long as its body, the Chinese scientists say. To Garth Dyke, a fossil bird specialist at the American Museum of Natural History in New York, its most significant feature is its tail - structured in strikingly similar fashion to those of many short-legged, fast-running dinosaurs. "It's kind of a mosaic," Dyke said, "of dinosaur and bird characteristics, and that's pretty cool, fresh evidence for the dinosaur ancestry of birds."

Equally important, he said, are the 50 round seeds that Zhou and Zhang discerned in the fossil bird's stomach, Dyke said. "It's hardly surprising that a bird ate seeds, but this is the first real evidence we've had that the early birds were in fact seed-eaters," he said.

Summary of story in the *San Francisco Chronicle*, July 25, 2002.

Large Fossil Fern Found in Canada

Scientists from Nova Scotia hope a huge fossil find will reveal more about the evolution of plants. The 300-million-year-old rock may contain one of the largest ever tree fern fossils found in Canada, geologists say. When the fern was growing, Nova Scotia was covered by a steamy rain forest. It differs from other fern fossils because of the way its branches leave the trunk.

"If it turns out to be what we think it is, then the reconstruction of the accepted structure or architecture of a tree fern, of a carboniferous tree fern, that is, will have to be rethought," said retired paleontology Prof. Erwin Zudrow of University College of Cape Breton. During the carboniferous period, plants first developed the ability to grow seeds. Scientists hope the boulder-sized fossil will shed light on how the process evolved.

A tractor driver unearthed the 315 kilogram fossil while digging in an

open pit mine. At four to five metres, the fossil is bigger than anything in the museum's collection. Bigger fossils like the Cape Breton find allow scientists to see the whole plant. "This is significant because it is the largest found in Nova Scotia and maybe Canada," said Debra Skilliter, head geologist at the National History Museum of Nova Scotia in Halifax. It will take a lot of close study to interpret the stems, but the fossil has already attracted international interest. British scientists may join in the effort to piece the fossil's story together.

Summary of story from *BBC News Online*, August 27, 2002.

Dinosaur Tracks Preserved on Scottish Island

Around 160 million years ago, a small group of large meat-eating dinosaurs walked along the sandy shore of a lake on Scotland's Isle of Skye, leaving their footprints in the sand. Cathie Booth, a Skye resident, discovered the first track on a loose sandstone rock while walking her dog on the beach. Fourteen more tracks have since been found. The tracks are the largest and the youngest dinosaur footprints ever found in Scotland. A research team headed by Neil Clark, a paleontologist at the University of Glasgow's Hunterian Museum, has explored the site; looking for more tracks and making molds of the 15 that have been uncovered. The find is particularly significant because the tracks still lie in the rock strata in which they were formed. "Tracks we've found before were all in loose boulders that had fallen down from the cliffs onto the beach," said Clark. "Finding them in their original horizon helps us define exactly how old they are."

Each footprint shows three huge toes, with the middle toe the longest. Judging from the size of the tracks, some of which are close to 20 inches (50 centimeters) long, the dinosaurs walked on two feet and probably measured about 33 feet (10 meters) from head to tail. The toes are very narrow, suggesting that the animal was a carnivore. Plant eating dinosaurs generally have toes that are more spatulate (spread out).

Dinosaur remains from the lower end of the Middle Jurassic, about 167 to 160 million years ago, are rare worldwide; there are only one or two places in the United States where remains of this age can be found, said Clark. He thinks a Megalosaurus may have made the tracks. "It's impossible to be 100 percent sure unless we follow the traffic and find a dead dinosaur at the end," he said. "But Megalosaurus was the only large meat-eating animal known at the time."

While today's Isle of Skye is cold and frequently battered by storms from the sea, 160 million years ago it was probably humid and swampy, said Clark. The Isle of Skye is known as Scotland's Jurassic Island because of the large number of dinosaur remains found there, and Clark is hoping the Skye beach will tell a larger story. During the Middle Jurassic, which extends from roughly 180 to 160 million years ago, the supercontinent Pangaea began to separate. Skye was separated from Africa and Europe at the time by several huge mountain ranges, which would present a barrier to the dinosaurs.

Clark plans to return this winter (Australian summer) to search for more tracks. In July over the course of about six days, winds pushed drifting sand over the tracks. The 15 discovered thus far have all been at the shallow end of the beach, buried under about five feet (1.5 meters) of sand. Clark expects a good winter storm to move the sand again, perhaps revealing more tracks. "We have people here who will be watching, walking their dogs, and will keep us informed on what's happening," he said. In the meantime, he and his team are taking molds of the footprints currently exposed, not excavating them. "We're leaving them here so people can look at them and see them as they were," he said.

Summary of story from *National Geographic News*, August 29, 2002.

Study: Dinosaurs Were Dying Before Asteroid Hit

A near 20-degree Fahrenheit drop in average temperature was killing the dinosaurs even before a giant asteroid impact finished them off, according to new research by a team of Canadian paleontologists. If correct, the finding explains why dinosaurs were so vulnerable to the impact, which many scientists agree caused the extinction of the dinosaurs and other prehistoric creatures around 65 million years ago. Evidence that climate change led to the dinosaur demise comes from a series of four collections of dinosaur-era fossils in Alberta, Canada. The fossils represent the last 10 million years of the Cretaceous, a relatively short period in geologic time. The Cretaceous spanned 146 to 65 million years ago. News on the research is reported in the journal *Chemistry & Industry*.

According to Don Brinkman, senior curator with the Royal Tyrrell Museum in Canada, changes revealed by the soil and rock around the fossils, such as the formation of coal and a decrease in certain plant

life, indicate a cool down accompanied by a drop in rainfall. Average temperatures went from a pleasant 77 degrees Fahrenheit to a rather chilly 59 degrees. Dinosaurs are thought to have been fairly tolerant of temperature changes, due to their mammal-like physiology. But turtles, crocodiles and other large reptiles in their ecosystem would have been more vulnerable.

"Within an ecological system, dinosaurs do not exist in isolation," Brinkman said. "They are members of an integrated system that includes plants, other vertebrates, and invertebrates. Temperature change could have affected dinosaurs by affecting these aspects of the ecosystem." As animal and plant food sources were dying out, so too were the dinosaurs. According to the report, up to one half of all dinosaurs had already died before the asteroid hit, leaving a weakened population susceptible to the massive collision.

Dale Russell, senior curator of paleontology and a visiting professor at North Carolina State University, agrees that the geological record shows a climate change during this period, but, he says, "I do not think that dinosaurs were dying off globally as a result of this (climate change) interval of about 65 million years ago." Russell added that a much more severe change in temperature patterns had occurred during the middle Cretaceous - about 100 million years ago - and "the dinosaurs did not become extinct, even in the tropics." Russell does, however, believe that the asteroid was a dinosaur killer. He said, "The planet-wide extinction of the dinosaurs seems closely related to (the asteroid) impact event."

Summary of story from *Discovery News*, August 30, 2002.

Archosaur Protein Recreated in Test Tube

American scientists have recreated for the first time a 240-million-year old protein from an archosaur.

Instead of using amber preserved DNA, as movie scientists did in "Jurassic Park," researchers at the Howard Hughes Medical Institute at the Rockefeller University and Yale University used statistics and a computer program to fabricate in a test tube a protein that codes for a pigment that would have characterized the eyes of archosaurs, the ancient reptiles from which dinosaurs evolved.

The pigment, called rhodopsin, was set into motion based on the

scientists "inferring" its protein sequence, Thomas P. Sakmar, head of Rockefeller University's Laboratory of Molecular Biology and Biochemistry, wrote in the September 2002 issue of *Molecular Biology and Evolution*. "Visual pigments, or rhodopsins, are the first step in vision, the molecular 'switch' that goes on in response to light. Without it, we and all other vertebrates are blind. Therefore biochemical properties of this molecule determine aspects of our vision," Belinda S. W. Chang, first author and research assistant professor at Rockefeller, said.

Basically, the vertebrate eye has a layer called the retina that detects different light wave frequencies with two types of cells: rods and cones. Rods detect light over a range of frequencies, whereas cones detect color frequencies, but require more light to function than rods. Rhodopsin is a protein that tells the rods to detect light.

About 220 million years ago, the archosaurs split into two branches. One of these branches led to the evolution of crocodiles; the other led to dinosaurs and, eventually, birds. Consequently, the scientists extrapolated the DNA sequence of the ancestral rhodopsin from known sequences in alligator, birds, frogs and fish. "Using our knowledge of how these vertebrates are related to each other, the sequence alignment and a model of how often certain types of genetic changes occur over time, we calculated the most likely gene sequence," said Chang.

Once they had the inferred gene sequence for archosaur rhodopsin, the scientists breathed life into it by placing it into mammalian tissue cell cultures. As expected, the gene instructed the cells to generate rhodopsin. "The archosaur protein that we synthesized in the laboratory represents, statistically speaking, our 'best guess' as to what would've existed back then. If our 'best guess' is correct, and we think it largely is, then the function of this protein gives us some indication of what the archosaurs would have been able to see," Chang said.

In lab tests, the light wavelength receptivity of the artificial protein showed values of 508 nanometers, which is close to birds, but farther away from existing vertebrates. As a result, the scientists suggested a "very speculative" hypothesis that archosaurs may have been capable of seeing in dim light, better suited to nocturnal life than expected.

According to dinosaur expert Matthew Bonnan, of Western Illinois University's department of Biological Sciences, the research will prompt scientists to re-evaluate their assumptions about dinosaur vision and behavior. But he warned that the theory of archosaurs roaming at night is highly speculative. "The study cannot tell us how many rods versus cones there were in archosaur eyes. This is important; because the number of rods to cones affects the way animals see in the day and night. Even with the red-shifted rhodopsin reported in this study, we have no way of knowing how many rods a particular archosaur had, and therefore we cannot know how well they used this protein to see at night, " he said.

Summary of stories from *Discovery News* & *BBC News Online*, September 13, 2002.

Dinosaur Hunters Hit Mother Lode

An ambitious five-year project aims to reconstruct an ancient ecosystem by connecting the dots between fossils.

Three years ago, when a team of dinosaur hunters first stumbled upon a bevy of Tyrannosaurus rex skeletons, they could have practiced old-school paleontology: piecing together the life stories of prehistoric creatures, one bone at a time.

Instead, as Jack Horner's crew jack hammered deeper into the Hell Creek geological formation, unearthing a diverse assemblage of ancient creatures and plants along the way, Mr. Horner says a larger vision began to take shape. The traditional practice of tagging and cataloguing individual specimens for museum display - "butterfly collecting," as Mr. Horner dubs it - became less important than connecting the dots between different species.

Now, the distinguished team is applying an "ecosystem approach" to their discoveries in an effort to reveal what the late Cretaceous period looked like 68 million years ago, just prior to end of the dinosaur age. The five-year "mega project" is intended to create a visual image that might also illuminate the imminent effects of modern global warming.

"The dig" is allowing us to look at patterns in evolution through time to see how environmental change affected life back then," Horner explains. "This work could help provide better insight into how plants and animals adapt to ecological change today." In the process, scientists are asking

themselves what relationship *T. rex* bones have to nearby duckbills and triceratops bones, and, in turn, how these fossilized specimens can shed light on the lives of mammals, mollusks, and plants.

The affable Horner, who oversees the department of paleontology at the Museum of the Rockies in Bozeman, Montana, is a shy man, yet he invariably attracts a lot of attention. After all, he is the closest thing paleontology has to a rock star. The protagonist in the film "Jurassic Park" was modeled after him. In scientific circles, he is renowned for his discovery of 20,000 duck bill dinosaurs eggs, at Egg Mountain, and his recent theory that the *T. rex* was more like a scavenging vulture than a predatory lion.

Yet, despite his reputation, the bearded dinosaur detective initially had difficulty finding any funding for the dig. Conventional wisdom suggested that Hell Creek had been picked over by a century's worth of other famous prospectors. Indeed, the National Science Foundation rejected Horner's grant proposal because he could not guarantee that significant finds could be made.

It wasn't going to be a cheap, small-scale operation. For starters, the tent encampment is large enough to be, in effect, the second-largest town in Garfield County. Adding to the cost: The slow nature of the dig. To reach the isolated excavation site the group makes a daily seven-mile trek upriver by speedboat and then hikes two miles in, the last mile across vertical terrain best suited for mountain goats. "It's rare that you have a paleontology project at this scale, but thinking bold has paid off," says physicist Nathan Myhrvold, the retired founder of research at Microsoft who is one a few individuals funding the project.

So far, eight *T. rex's* and a mother lode of other valuable specimens have been found. To put that into perspective, that accounts for one-third of all known *T. rex* skeletons. The crew's haul also boasts two-dozen triceratops skeletons, several edmontosaurus', and potentially the largest duckbill dinosaur skeleton yet discovered, measuring between 45 to 50 feet long.

However, it is the diversity of other smaller fossils, such as elaborately ornate snails, fossilized fruit, and long nosed fish, that most excites Horner and colleagues like mammalogist Bill Clemens and botanist Nan Arens from the Museum of Paleontology at the University of California-Berkeley.

"If you just see a certain percentage of diversity coming out of the ground, and focus on single species, you're glazing over a lot of things," adds Joseph Hartman, a malacologist from the University of North Dakota who specializes in ancient clams and snails. Along with these creatures, scientists say it's significant that more *T. rex's* have been found than prey species such as duckbills. "*T. rex* appears to have been much more common than we thought," says Horner.

The paleontologist has a hunch that, prior to a cataclysmic event such as an asteroid impact around 65 million years ago, other changes were occurring in the environment. Around 75 million years ago, Horner says, a trend toward extinction of many taxa of dinosaurs was underway. "We are seeing evidence of ecological instability. The question is why?" Mr. Hartman asks. Contorted plant fronds and fresh-water mollusk shells indicate stressful environmental conditions that provide potential clues on how environmental changes were affecting different kinds of life.

According to Mr. Myhrvold, the issues being addressed by paleontology are remarkably timely. Learning about climate change in previous ages can help experts better anticipate how the biota will respond to changing weather patterns in the decades ahead. Thus far, it appears that common species fared far better in a changing environment than the organisms with specific adaptations - not dissimilar from endemic creatures that end up on the endangered species list.

"Dinosaur paleontology might seem like one of the least-applied sciences in the 21st century," Myhrvold says, "but I believe the knowledge it is giving us might some day help us save our world."

Summary of story from the *Christian Science Monitor*, September 10, 2002.

Bucktoothed Dinosaur Found in China

It's small, it's fast, and it's bizarre-looking. Paleontologists in China have discovered the skull of a new dinosaur species with beaver-like buckteeth on its upper jaw and the beginnings of a beak on its lower jaw. The skull is around 128 million years old and was found in Liaoning Province, a region in northeastern China that has proven to be a spectacular treasure trove of dinosaur fossils.

Named *Incisivosaurus gauthieri* for its mouthful of weird teeth, it is the oldest fossil of an oviraptorosaur yet found. It also goes a long way to

solving the puzzle of what they ate. "This early skull is the first hard evidence scientists have that at one point oviraptorosaurs were herbivorous," said Xu Xing, a paleontologist at the Institute of Vertebrate Paleontology and Paleoanthropology, Beijing, China. Xu and colleagues report on the find in the September 19, 2002 issue of the journal *Nature*.

Oviraptorosaurs evolved sometime in the Early Cretaceous (144 to 127 million years ago) and belong to a group of meat-eating dinosaurs known as theropods. Up until now, fossils of oviraptorosaurs came primarily from the Late Cretaceous (89 to 65 million years ago) and were considered a somewhat bizarre branch of the theropod family. They were toothless, had beaks and many had a high-domed parrot-like head. These features are quite different from those of other theropods.

The 100 millimeter (4 inch) *Incisivosaurus* skull is longer and lower than that of later oviraptorosaurs, and more closely resembles more traditional theropods, providing scientists with a bridge between early and later forms. The most striking feature of the *Incisivosaurus,* which was probably around one meter (three to four feet) long, is its mouthful of teeth.

"It doesn't have a true beak," said Peter Makovicky, a paleontologist at the Field Museum in Chicago who has done extensive work on dinosaurs with beaks. "It has a beak at the edge of the lower jaw, but the upper jaw has two enormous, beaver-like incisors [front teeth]. Behind them are small, pointy teeth. The cheek teeth, if you can call them that, are leaf-shaped. It's a very complex and weird dentition." The teeth would be more suitable for gnawing than for slicing or cutting. Over time, oviraptorosaurs lost all their teeth and evolved a full beak, and paleontologists have long been curious as to what they ate.

Early fossils were found near nests, giving them their name, oviraptorosaur, which means egg thief. Later finds made it more likely that they were sitting on the nests - hatching, not eating the eggs. A lizard skeleton found in the gut of one fossil suggested that they were indeed carnivores.

But the tooth structure and wear patterns of the *Incisivosaurus* show the best evidence found to date for herbivory among theropods, said

Makovicky. "These teeth are totally inappropriate for eating meat," said Philip Currie, a paleontologist at the Royal Tyrell Museum of Palaeontology in Canada. "Even with the beak, we had always assumed that oviraptorosaurs were still carnivorous - hawks and eagles do it quite well. But these teeth are teeth you expect to see in an herbivore."

The pattern of tooth loss that led to the eventual development of a full beak in later forms is different from patterns seen in birds, and suggests there are more complex evolutionary scenarios for beak development than previously thought, said Makovicky.

Most paleontologists believe that modern birds evolved from small non-flying theropods around 150 million years ago. The theory is backed by the fact that theropod dinosaurs and birds share more than 100 anatomical features, and by the feathered theropod fossils found in the last several years in China. Dromaeosaurs, a group of small, fleet-footed dinosaurs in the theropod family, are thought to be the closest known relatives of birds.

Several recent studies have suggested that instead, birds evolved from oviraptorosaurs, based on a series of characteristics shared by both, including toothless jaws, short nasals, and other morphological similarities. But the fact that *Incisivosaurus,* an early oviraptorosaur at 128 million years old, doesn't have any of the birdlike features at a time when birds had already evolved, suggests that it may be more a case of convergent evolution - two groups evolving similar features at the same time but independently. "Lots of species that aren't birds have evolved beaks; turtles, for instance," Currie said.

The *Incisivosaurus* fossil comes from the Yixian Formation, layers of volcanic and sedimentary rock deposited between 145 and 120 million years ago. The region has yielded an enormous variety of fossils, including feathered dinosaurs, fish, birds, insects, crocodiles, lizards, turtles, flowers, and mammals, and is changing how we view dinosaurs.

"One theory has it that there were only 500 species of dinosaurs spanning 150 million years, and most were small," said Currie. "In Liaoning, we're seeing an explosion of fauna - they've found something like 30 species already and all from the same time period. The shapes are a lot more bizarre than we ever imagined, they're doing things differently - carnivores eating plants, for instance - and most are small.

"The worlds of the past are opening up to us and changing what we thought we knew. It's just mind-boggling, and very exciting."

Xu Xing said the significance of the *Incisivosaurus* fossil is how little is known about dinosaurs. "There is a lot that we don't know - dinosaurs are really a big family with great diversity."

Summary of story from National Geographic Online, September 13, 2002.

Fossil Sharks Teeth May Point to How Vertebrates Evolved

An Australian researcher believes a shark fossil that had been gathering dust at a museum in New Brunswick, U.S.A., might hold clues to the evolution of vertebrates. The specimen is the oldest fossil of a shark known to have teeth set in its jaw. The fossil is estimated to be 410 million years old, and it is the most complete specimen of *Doliodus problematicus*. Dr. Sue Turner, a vertebrate paleontologist from the Queensland Museum in Australia, received a fellowship to come to the province to study the fossil, which is less than a metre long.

The fossil was found near Campbellton, New Brunswick, U.S.A., in 1997. Turner has specialized in studying teeth for 20 years, and said the find could help explain how teeth evolved in all vertebrates. "This shark was only known from its teeth," said Turner. "Then this complete specimen turned up, which is a delight because we've got a big piece of the puzzle to help solve the lifestyle and mysteries of this particular shark."

Past findings of shark fossils included mainly single teeth and scales. Sharks are mostly made of cartilage, which doesn't preserve well, Turner said. She said the skeleton is important because it proves shark fins once had spines. Until now, scientists didn't know sharks had spines in their pectoral fins. Researchers had thought ancient fish lacked jaws, and instead had scales all over their mouths for grinding.

Extract of story from CBC News Online, September 19, 2002.